Remarks

Claim 1 was pending in the application. In the Office Action, claim 1 is rejected. In the instant Amendment, claim 1 has been amended for editorial purpose, and new claim 8 has been added. Support for new claim 8 is found in the specification at page 10, line 26 through page 11, line 30. No new matter has been introduced by the present amendment. Upon entry of the instant Amendment, claims 1 and 8 will be pending in the application.

Entry of the foregoing amendment and consideration of the following remarks are respectfully requested.

Claim rejection under 35 U.S.C. §103

Claim 1 is rejected under 35 U.S.C. §103(a) as being unpatentable over EP 1160346 to Takada, et al. ("EP '346") in view of U.S. Patent No. 7,090,731 to Kashima, et al. ("US '731") for the reasons set forth on pages 3-7 of the Office Action.

The presently claimed invention is directed to a hot dip galvanized high strength steel sheet, excellent in plating adhesion and hole expandability. The presently claimed hot dip galvanization steel sheet is characterized in that the steel sheet has a metal structure having, by area ratio, 3.5 percent to 10 percent of tempered martensite, by volume percent, 5 percent to 11 percent of residual austenite, ferrite, and bainite. By including these in the steel sheet in a good balance, it is believed that the workability and hole expandability are improved. Further it is believed that by annealing and cooling to the martensite transformation point or less, and heating the steel at a low temperature for hot dip galvanization, the balance of hardness between the soft structure and hard structure is improved, and the local elongation is improved, and thereby the hole expandability is improved. See, the specification at page 9, line 6 to page 10, line 25.

Example 1 of the present specification shows a comparison between exemplary galvanized steel sheets produced by the conventional method and the inventive method. In the conventional method, after cooling to 450°C, the sheets were hot dip galvanized and hot dip galvannealed at a temperature of 500°C without pickling or pre-plating, and then cooled to ordinary temperature and were 1% temper rolled to obtain the final products. The mechanical properties, metal structures, hole expendabilities, plating adhesions, and other various characteristics of the products obtained by the conventional method are presented in Table 2 (i.e., as comparative examples). In the inventive method, after cooling to 450°C, the

sheets were held at a temperature of 400°C for 180 seconds for over aging, then cooled to the martensite transformation point or less, pickled by 5% hydrochloric acid, pre-plated with Ni to 0.5 g/m^2 per side of the sheet, heated to a temperature of 500°C, hot dip galvanized and hot dip galvannealed, cooled to ordinary temperature, then 1% tempered rolled to obtain the final products. The mechanical properties, metal structures, hole expendabilities, plating adhesions, and other various characteristics of the products obtained by the inventive method are presented in Table 3 (i.e., as inventive examples).

As shown by Figures 1 and 2 below, when comparing the tensile strength TS vs. the elongation El and the hole expansion rate of the steel sheets produced by the inventive method and the conventional method, the steel sheets obtained based on the method of the present invention show superior elongation and hole expansion rate.

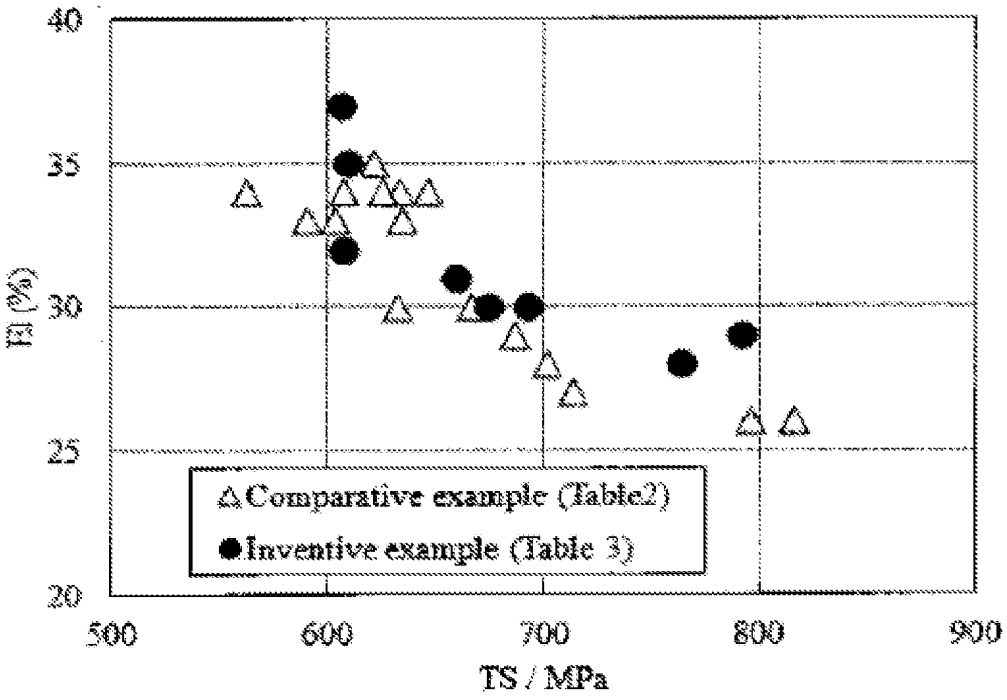

FIG. 1

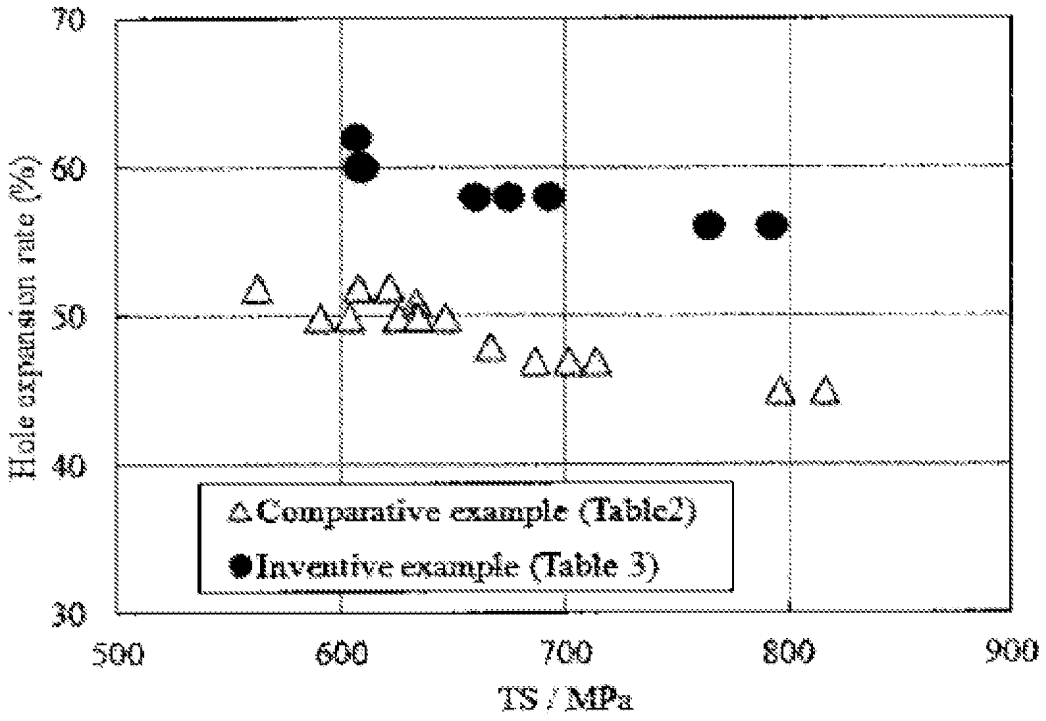

FIG. 2

US '731 provides a high strength steel sheet having excellent formability (stretch flange formability and total elongation). More specifically, US '731 is concerned with a high strength steel sheet having both high strength of the order of 500 to 1400 MPa and excellent formability in an ultra-high strength region. US '731 is also concerned with providing a steel sheet superior in fatigue characteristic and bake hardening property (*see* US '731, col. 1, ll. 6-18). US '731, however, does not teach or suggest the hot dip galvanization steel sheet of the presently claimed invention excellent in plating adhesion and hole expandability.

According to US '731, in order to allow the effect of improving the stretch flange formability by the tempered martensite to be exhibited effectively, it is necessary that the tempered martensite be present not less than 50% (preferably not less than 60%) in terms of a space factor relative to the whole structure (*see* US '731, col. 10, ll. 63-66). This amount of tempered martensite is far higher than the 3.5 to 10% of the presently claimed invention.

In the Office Action, the Examiner acknowledges that EP '346 does not teach 3.5 to 10% of tempered martensite in the steel, but contends that US '731 teaches steel microstructure with 10% tempered martensite and 5% retained austenite in sample 15 in Table 39, which is within the claimed ranges of the tempered martensite and the retained austenite as recited in the instant claims. Therefore, it would have been obvious to one of ordinary skill in the art to control the microstructure of the galvanized steel through the heat treating process as demonstrated by US '731 for the steel of EP '346 in order to obtain a steel with both high strength and excellent formability.

However, US '731 teaches that its sample 15 is a comparative example produced by a method in which the SRT is outside the range of 950 to 1150 °C (in the method for producing example 15, the SRT is 925 °C; see Table 38), and that this example exhibits markedly deteriorated BH: BH (2%) being 30 MPa and BH (10%) being 10 MPa (*see* US '731, Example 15, and Table 39; and the discussion at col. 65, lines 1-17). US '731 discloses that its steel sheet should satisfy: BH(2%) ≥ 70 MPa and BH(10%) ≥ BH(2%)/2, i.e., 35 MPa (*see* US '731, col. 37, ll. 11-17). Thus, US '731 clearly discloses that the steel sheet of example 15 does not have the desired properties. US '731 not only would not have led a person skilled in the art to the claimed steel sheet which contains, *inter alia*, 3.5 to 10% tempered martensite, but also teaches away from a steel sheet having such an amount of tempered martensite.

Thus, US '731 does not cure the deficiencies in EP '346. One skilled in the art would not have been led to the hot dip galvanization steel sheet of the presently invention excellent in plating adhesion and hole expandability based on the disclosures of US '346 and US '731. Accordingly, the rejection of claim 1 as being obvious over US '346 in view of US '731 cannot stand, and should be withdrawn.

Claim 1 is rejected under 35 U.S.C. §103(a) as being unpatentable over JP 2003105491 to Masaaki, et al. ("JP '491") in view of EP '346.

In the Office Action, the Examiner acknowledges that JP '491 does not teach adding 0.0001 to 0.003 wt% of B to the steel, but contends that EP '346 teaches adding 0.0002 to 0.01 wt% of B in the alloy, which overlaps the boron range as recited in the instant claims. Therefore, it would have been obvious to one of ordinary skill in the art to add proper amount of B as demonstrated by EP '346 in the steel of JP '491 because EP '346 teaches that B is co-present with Cu and lowers the transformation point to inhibit precipitation of cementite and

increase the volume percentage of retained austenite by delaying the progress of transformation. The Examiner also contends that JP '491 teaches about 5% retained austenite and generates 3-5% martensite (in ¶ [0042] of JP '491) which overlaps the claimed ranges. Applicants respectfully disagree.

JP '491 teaches a high strength steel sheet and galvanized steel sheet having excellent formability. The galvanized steel taught by JP '491 has a metallic structure containing ferrite, 5 percent or more retained austenite, and bainite. JP '491 does not teach or suggest the desirability of a steel sheet containing 3.5 -10% of tempered martensite. According to ¶[0042] of a machine-translated JP '491, obtained from the Industrial Property Digital Library (IPDL) of JPO (a copy is submitted in a Supplemental Information Disclosure Statement filed concurrently herewith):

> [0042] About the experimental run number 99 - 103 and an ingredient sign B, I, and P, U, and AD, since the cooling rate (=CR) was low in 3°C/[sec and], the formula 3 was not satisfied, and, as a result, sufficient retained austenite was not formed, but construction material was poor. **About the experimental run number 104 - 108 and an ingredient sign B, I, and P, U, and AD, since the cooling rate was too quick in 100°C/[sec and], the formula 3 was not satisfied, but, as a result, 3% - 5% of a lot of martensite generated during the organization, and it became poor [construction material] because intensity becomes high too much and ductility gets worse. The rate of retained austenite also fell.** (with emphasis added).

Thus, JP '491 discloses that when a large amount of martensite e.g., 3-5% was generated, formula 3 is not satisfied, resulting in poor construction material and ductility worsens. In addition, the rate of retained austenite falls. Therefore, JP '491 teaches away from a steel sheet having a metallic structure containing 3.5 - 10% of tempered martensite.

In addition, JP '491 does not teach or suggest the claimed process of cooling the steel sheet to the martensite transformation point or less, then heating to a temperature at 250° to 600°C. And as discussed previously in the Amendment dated April 14, 2010, the process of JP '491 would not produce the presently claimed hot dip galvanization steel sheet. Therefore, JP '491 fails to teach or suggest the hot dip galvanization steel sheet of the presently claimed invention.

As discussed above, EP '346 also does not teach 3.5 to 10% of tempered martensite in the steel, thus, EP '346 does not cure the deficiencies in JP '491. Therefore, one skilled in the art would not have been led to the hot dip galvanization steel sheet of the presently invention

based on the disclosures of JP '491 and US '346. Accordingly, the rejection of claim 1 as being obvious over JP '491 in view of US '346 cannot stand, and should be withdrawn.

Double Patenting rejections

Claim 1 is provisionally rejected on the ground of nonstatutory obviousness type double patenting, as allegedly being unpatentable over claims 1 to 7 of co-pending U.S. Patent Application No. 10/560,989 ("the '989 application"), over claims 1-10 of co-pending U.S. Application No. 10/558,579 ("the '579 application"), and over claims 1-3 of co-pending U.S. Application No. 10/591,919 ("the '919 application"), all in view of US '731.

Since neither of the '989 application, the '579 application, and the '919 application has issued, Applicants respectfully request that a response to these rejections be deferred until such time when it is the only outstanding issue remaining in the present application.

In view of the foregoing amendments and remarks, Applicants respectfully submit that the present application is in condition for allowance. Early and favorable action by the Examiner is earnestly solicited. If the Examiner believes that issues may be resolved by a telephone interview, the Examiner is invited to telephone the undersigned at the number below.

Respectfully Submitted,

Date: January 12, 2011

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